General Ecology, Inc. – First Need® Base Camp

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Device Information

The General Ecology, Inc., First Need Base Camp is a portable pump water treatment device utilizing what the manufacturer calls a proprietary "structured matrix" media for pathogen reduction. According to the manufacturer, the reduction process consists of microfiltration (0.1 µm nominal, 0.4 µm absolute pore size), chemical adsorption, and electrochemical attraction. The proprietary media consists of a block of activated carbon treated to enhance retention of viruses and other microorganisms by way of association with the media surface. The device consists of a coarse metal screen pre-filter, finer mesh pre-filter cartridge, hand pump, filter canister within a stainless steel housing, and effluent spout. All components are connected by flexible tubing. The user places the influent tubing and coarse pre-filter into the raw water source, strokes the hand pump and water is forced through the device and out of the spout whereby a user supplied vessel captures the purified water. The device also comes with blue dye for filter canister integrity testing and a padded water resistant storage bag.

Effectiveness Against Microbial Pathogens

Results from an independent study using the General Ecology First Need Deluxe (reference 1 and 2) show that when challenged against the U.S. Environmental Protection Agency (USEPA) Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 3), the device met the pathogen log reductions, shown below, based on geometric averages of three identical devices. During testing, production capacity was set at 378 L per device and flowrate at 0.476 L/min, both below the manufacturer stated values. The First Need Base Camp device uses the same removal canister as the First Need Deluxe so similar results can be expected. Since the data reviewed was for not for the Base Camp and was for a production rate and capacity below the manufacturer stated rates, one √ is assigned for pathogen reduction (click here for rating explanation), indicating that expert opinion expects this device to meet the requirements of reference 1. More data, specific to this device, is required for a higher rating.

® First Need is a registered trademark of General Ecology, Inc., Exton, PA. Use of trademarked products does not imply endorsement by the U.S. Army, but is intended only in identification of a specific product.

Table. Expected Performance Against Microbial Pathogens.

Microbial Pathogen Type	Expected Disinfection Capability	Evaluation Rating	Primary Pathogen Reduction Mechanism
Bacteria	> 6-log	√	size exclusion
Viruses	> 4-log	√	electrostatic attraction
Giardia cysts	> 3-log	√	size exclusion
Cryptosporidium oocysts	> 3-log	√	size exclusion

Production Rate and Capacity

Inherent to the production rate and capacity of filtration devices is the quality of the raw water source. Manufacturer stated production rate is 1.9 L/min, and overall capacity of the media canister is 1900 L based on what the manufacturer calls "clean wilderness waters." Capacity will vary widely with raw water turbidity. The flowrate used during microbial pathogen studies was 0.476 L/min and 378 L, far below the 1.9 L/min and 1900 L manufacturer stated flowrate and production capacity during normal operation.

Cleaning, Replacement, and End of Life Indicator

The filter canister cannot be backwashed. When pumping becomes difficult during normal operation or when 1900L have passed through the device, the filter canister should be replaced. For long term storage the manufacturer recommends passing one pint of dilute bleach (1/6 tsp / pint) through the device then flushing the device and tubing with clean water. The prefilters can be backwashed by changing tubing configuration to reverse flow direction. The hand pump can be serviced by disassembling and cleaning. Device instructions state to conduct integrity testing prior to each trip, and if device freezes or is subject to shock loads. Integrity testing consists of adding provided blue food dye to water then pumping it through the device. If even the faintest of blue color is present in the processed water, the canister must be replaced.

Weight and Size

The dry weight of the device is estimated to be about 2000 grams. Dimensions are as follows:

Overall dimensions collapsed (height x width x length)	15 cm x 18 cm x 25 cm
Pressure vessel (diameter x height)	20 cm x 13 cm

Pump height	26.7 cm
Inlet hose with pre-filter	88.9 cm

Cost

Complete device	$557.00
Replacement canister	$75.00

Device Evaluation

No data was received specific to challenging the General Ecology, Inc., First Need Base Camp against reference 3. Based upon independent published data (reference 1) reviewed for the General Ecology First Need Deluxe, utilizing the same treatment technology, the First Need Base Camp should be capable of meeting the requirements of reference 3. Bacteria and cyst reduction based on size exclusion by microfiltration is a proven technology and an intact membrane will effectively reject these microbes (reference 4). Virus removal by the "structured matrix" is based on electrochemical attraction, and although shown to be effective under laboratory conditions, is not considered as consistent of a reduction mechanism as size exclusion. Virus attraction to solid surfaces is highly affected by virus type, charge, and water pH, and therefore, removal efficacy is highly variable (reference 5). There also exists the possibility for release of previously attracted viruses from this media under certain water quality conditions. Since this device utilizes electrochemical adsorption, the flowrate through the device can have a dramatic effect on pathogen reduction. To ensure safe water production, the device should not be operated above the flowrate of 0.476 L/min or beyond the production capacity of 378 L, the flowrate and capacity shown to meet the above pathogen reductions (reference 1). Users cannot be expected to regulate flowrate during production, adding uncertainty to the expected virus reduction claims, and stressing the importance of laboratory testing at device recommended conditions. This device requires no chemical addition and no wait time prior to water consumption. There is no indicator of process failure on a real-time basis, and end of device useful life is based on integrity testing, filter clogging, or by the user keeping track of the volume of water purified. Inherent to treatment devices utilizing small pore size membranes is the likelihood of clogging when processing highly turbid raw water. Although this device uses two backwashable pre-filters, this inherent disadvantage is still valid. According to manufacturer instructions, during backwashing of the canister, the pump inlet is to be placed into clean water. This requires the user to have access to an additional clean container, as once the pump inlet is placed into the clean container it is now contaminated with raw water. The user's drinking water vessel should not be used as the source for backwashing. Integrity testing of the device, recommended before expected use and after freezing of device, entails visual inspection of product water after placing blue dye in the raw source. The ability of the user to detect slight

color change is uncertain, making this a questionable technique for determining device failure. Device instructions state not to allow device to freeze. Device temperature range stated at 33 - 145º F. No storage life is stated.

Advantages

- Independent testing for a device utilizing the same technology confirms bacteria, virus, and protozoan reduction in accordance with the USEPA Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 3) at a reduced flowrate and production capacity.
- No chemicals required.
- No wait time prior to consumption.
- Pre-filters capable of backwashing to remove accumulated debris.

Disadvantages

- No data supplied for this specific device that shows pathogen reduction in accordance with the USEPA Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 3).
- Testing for pathogen reduction efficacy was not conducted at manufacturer stated flow conditions, making applicability of results to actual use questionable.
- Electrochemical virus attraction by proprietary media is not widely proven technology and efficacy may be affected by raw water quality.
- No ability to backwash filter canister once clogged.
- Mechanical sieving inherently prone to clogging with high turbidity waters.
- No real-time indicator of process failure.

References

1. Gerba, C.P., and Naranjo, J.E., 2000. Microbiological Water Purification Without the Use of Chemical Disinfection. *Wilderness and Environmental Medicine*. 11:12-16.

2. Independent laboratory results of tests showing compliance with the USEPA Guide Standard and Protocol for Testing Microbiological Water Purifiers, 1995. Provided by General Ecology.

3. USEPA, 1989. Guide Standard and Protocol for Testing Microbiological Water Purifiers. *Federal Register*. 54:34067.

4. U.S. Army Center for Health Promotion and Preventive Medicine, 2005. *Technical Information Paper; Filtration in the Use of Individual Water Purification Devices*, Aberdeen Proving Ground, MD.

COTS Purifiers – Army Study Program, Project No. 31-MA-03E0-05.

5. Gerba, C.P., 1984. Applied and Theoretical Aspects of Virus Adsorption to Surfaces. *Advances in Applied Microbiology*. 30:133-168.